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X-ray Reflectivity Study of Protein Adsorption to Langmuir Monolayers of Metal-chelating Lipids

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Introduction: A versatile method for targeting proteins to lipid assemblies has been developed recently using metal ion coordination [1,2]. Many important questions remain regarding the adsorbed conformations of the proteins under various conditions and the affect on the lipid bilayers. In this work we examined this system in the form of Langmuir monolayers using X-ray reflectivity.

Methods and Materials: Mixed lipid bilayers and Langmuir monolayers were prepared which contained 1,2-dipalmitoyl-sn-glycero-3-phosphoholine (DPPC) along with a specially synthesized metal-chelating lipid (PSIDA). The active headgroup on PSIDA is an iminodiacetate moiety. It has been demonstrated that proteins bind to such assemblies with chelated divalent copper, calcium, or nickel ions via surface accessible histidine residues. Protein binding was demonstrated from surface pressure isotherms. X-ray reflectivity experiments were performed as a function of lipid composition, the sequence of loading the lipids with metal ions and spreading the monolayer, and the concentration of myoglobin in the subphase.

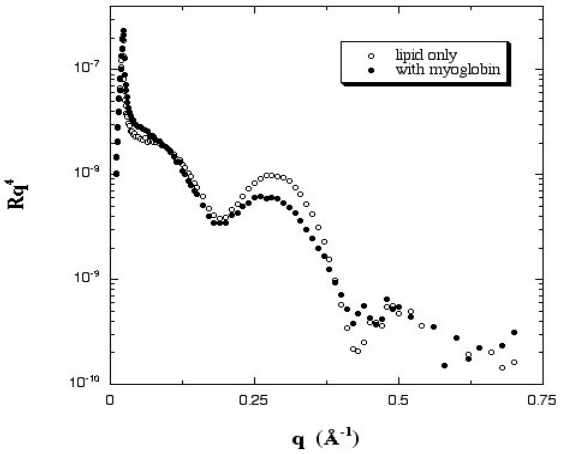

Figure 1. Change in reflectivity upon adsorption of myoglobin to a Cu(II)-chelating lipid monolayer.

Results: The data in Figure 1 indicate the change in reflectivity upon binding of myoglobin to the pure PSIDA monolayer preloaded with Cu^{2+} ions prior to spreading. Analysis of these data is underway to determine the electron density profile of the adsorbed myoglobin and mixed lipid layers.

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References:

[1]. D. R. Shnek, D. W. Pack, D. Y. Sasaki, F. H. Arnold "Specific Protein Attachment to Artificial Membranes Via Coordination to Lipid-Bound Copper(II)" *Langmuir*, **10**, 2382-2388, (1994).

[2]. K. Ng, D. W. Pack, D. Y. Sasaki, F. H. Arnold "Engineering Protein-Lipid Interactions: Targeting of Histidine-Tagged Proteins to Metal-Chelating Lipid Monolayers" *Langmuir*, **11**, 4048-4055, (1995).